Final
Removal Action Design Work Plan
Former Stono Phosphate Works
Charleston, South Carolina
AOC CERCLA-04-2005-3758

Exxon Mobil Corporation
Houston, Texas

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Acronyms and Abbreviations

AOC	Administrative Order on Consent
BBL	Blasland, Bouck & Lee, Inc.
BOD	Basis of Design
bgs	below ground surface
CA	Cost Analysis
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CWA	Clean Water Act
cy	cubic yard
EE	Engineering Evaluation
ERM	Effects Range-Median
GCM	Geochemical Conceptual Model
HASP	Health and Safety Plan
LPEB	lower-permeability exposure barrier
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NCP	National Contingency Plan
NTCRA	Non-Time-Critical Removal Action
POTW	public owned treatment works
OCRM	Office of Coastal Resource Management
OSHA	Occupational Safety and Health Administration
QAPP	Quality Assurance Project Plan
RADWP	Removal Action Design Work Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SSAL	Site-Specific Action Level
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VCC	Virginia-Carolina Chemical Company

1. Introduction

1.1 Purpose and Objective

This document presents the *Draft Removal Action Design Work Plan* (Draft RADWP) for the Stono Phosphate Works Site (site) located in Charleston, South Carolina (Figure 1). This document was prepared on behalf of ExxonMobil Corporation (ExxonMobil) and describes the major pre-design and design tasks necessary to develop a Removal Action Design for the various removal requirements of the site. The conceptual removal action approach to satisfying the removal action requirements of the site was established through United States Environmental Protection Agency (USEPA) approval of the *Engineering Evaluation/Cost Analysis Report, Former Stono Phosphate Works Site* (EE/CA Report) (Blasland, Bouck & Lee, Inc. [BBL], June 2004). The *Action Memorandum* (USEPA, September 30, 2004), which documents USEPA approval of the EE/CA Report, is included in Appendix A.

The Action Memorandum states that a Non-Time-Critical Removal Action (NTCRA) be conducted in compliance with all federal and state applicable, relevant, and appropriate chemical-, action-, and location-specific requirements. The Action Memorandum additionally requires that the NTCRA be performed and funded by ExxonMobil and be overseen by the USEPA and the South Carolina Department of Health and Environmental Control (SCDHEC).

This Draft RADWP was developed in accordance with the Administrative Order on Consent (AOC) for Removal Action for the site entered into voluntarily by ExxonMobil and the USEPA. The Docket Number for the AOC is CERCLA-04-2005-3758, and the effective date is February 1, 2005. The AOC provides for the performance of the Removal Action by ExxonMobil at the former Virginia-Carolina Chemical Company (VCC) property located in Charleston, South Carolina.

In accordance with the AOC, the objective of the Draft RADWP is to describe, in concise format, the major pre-design and design tasks necessary to develop a complete site-wide design for all NTCRA requirements at the site. This Draft RADWP document has been developed around the proposed RADWP Implementation Schedule for the site.

1.2 Site Description

The site is located in the Charleston Heights section of Charleston, South Carolina, and lies north of downtown Charleston, on the west side of the peninsula formed by the Ashley and Cooper Rivers. As shown on Figure 1, the site is located west of Interstate 26 and adjacent to the Ashley River. Figure 1 shows the location of the site in relation to the two other local former VCC sites also being addressed by ExxonMobil. Figure 2 consists of an aerial photograph that provides further detail of the site.

The site encompasses approximately 15 acres. All structures relating to the fertilizer works were removed by 1973. In 1982, Ashley River Industries, Inc. acquired the property and constructed the Dolphin Cove Marina. Dolphin Cove Marina currently occupies the property and conducts dry stack boat storage and repair. The two major structures that currently occupy the property are the dry stack boat storage building and an adjacent building occupied by the marina offices, banquet facilities, and boat engine repair shop. Other smaller buildings

onsite include a building for storage, two mobile homes, and the marina restaurant, known as the Dolphin Cove Café, which is currently closed.

The objectives of the site EE/CA Report, which was completed in June 2004, were to:

- evaluate the nature and extent of potential environmental risks to the public and the environment; and
- develop and evaluate alternatives for an NTCRA that addresses the migration or release of hazardous substances.

The EE/CA Report identified the preferred Removal Action Alternatives that will be discussed in Section 2. In general and as shown on Figure 3, the NTCRA required by the USEPA for the site consists of the following components:

- removal of site soil via stabilization and installation of an onsite lower-permeability exposure barrier (LPEB);
- interception of offsite migration of impacted groundwater through collection and, if needed, treatment; and
- removal of marsh sediment by excavation and onsite containment of excavated sediments beneath the LPEB, and restoration of the marsh to original conditions.

The general NTCRA components are identified on Figure 3.

1.3 Planned Future Property Use

As stated in Section 1.2, the property is an active recreational boat marina (Dolphin Cove Marina), owned by Ashley River Industries, Inc. Changes in property use are not anticipated in the foreseeable future.

1.4 Implementation Schedule

The Draft RADWP implementation schedule (Figure 4) lists the pre-design and design activities and depicts their implementation sequence, duration, and interrelationships. This Draft RADWP implementation schedule can be used as the basis for guiding the design process. It will be updated as work proceeds, with USEPA concurrence. As shown on Figure 4 and outlined in the following sections, several preliminary design documents will be prepared during the removal action design process. These documents will be submitted to the USEPA and SCDHEC for review and comment. However, in some instances, implementation of additional design activities (e.g., commencement of a subsequent design deliverable) will continue concurrently with USEPA and SCDHEC review until the Final Removal Action Design documents are completed and submitted to the USEPA and SCDHEC.

It is ExxonMobil's intention to keep the USEPA and SCDHEC informed of all activities described in the Draft RADWP. At the same time, formal USEPA and SCDHEC review and written approval are scheduled at key steps in an effort to meet the NTCRA design schedule in accordance with the AOC. USEPA and SCDHEC comments from the concurrent reviews will be incorporated into the final designs, as appropriate.

1.5 Report Organization

The introduction provided in this section is followed in Section 2 with a description of the selected NTCRA components for the site. Section 3 provides a discussion of the sequencing and design packages, and Sections 4, 5, 6, and 7 provide details on Design Package No. 1 – Demolition Plan for Storage Yard, Design Package No. 2 – Slag Soil Stabilization and LPEB, Design Package No. 3 – Groundwater Containment and Treatment System, and Design Package No. 4 – Sediment Removal and Marsh Restoration, respectively. Section 8 discusses the Project Plans, specifically the Health and Safety Plan (HASP), Quality Assurance Project Plan (QAPP), Permitting Plan, and Project Management Plan. Section 9 discusses project organization and progress reporting.

2. Selected Non-Time-Critical Removal Action

2.1 Selected NTCRA

In June 2004 and on behalf of ExxonMobil, BBL submitted the EE/CA Report to the USEPA. The EE/CA Report presents the evaluation of various removal options for addressing potential impacts associated with site upland soils, groundwater, and marsh sediments.

The proposed NTCRA for the site that was presented in the EE/CA Report and outlined in the USEPA Action Memorandum consists of the following components:

- stabilization of slag and magenta-stained soil, and installation of an onsite LPEB over both stabilized soil and unstabilized surface soil (0 to 1 foot below ground surface [bgs]) exceeding USEPA- and SDHEC-approved Site-Specific Action Levels (SSALs) of 27 milligrams per kilogram (mg/kg) for arsenic and/or 895 mg/kg for lead combined with institutional controls on future land use;

- construction of a groundwater containment, collection, and treatment system at the site combined with institutional controls to prevent future groundwater use; and

- excavation of marsh sediment exceeding the SSALs (Mean Effects Range-Median [ERM] Quotient: Category 3 and 4), containment of excavated sediment in upland areas of the site beneath the LPEB, and restoration of the marsh to pre-existing conditions.

2.2 Slag Soil Stabilization and Lower-Permeability Exposure Barrier (Upland Soil Alternative 4)

This NTCRA component consists of stabilizing visually identified slag and/or magenta-stained soil at several locations throughout the site, as shown on Figure 3. Stabilization estimates currently include approximately 11,000 cubic yards (cy) of vadose zone soils and 5,500 cy of saturated zone soils. Excavation areas within the vadose zone will be backfilled with the stabilized material, and excavation areas in the saturated zones will be backfilled with clean soil.

Following stabilization, an LPEB will be installed across approximately 5.7 acres of the 15-acre site. The LPEB will function as a barrier to both human exposure and the infiltration of rainwater and will consist of 12 inches of compacted soil or an equivalent alternative (e.g., streets, parking lots, and/or building pads). Underlying the LPEB will be a geotextile for demarcation purposes. The estimated capital cost for this removal component is approximately $1.6 million. The estimated present net worth for O&M costs is $0.1 million.

2.3 Groundwater Containment and Treatment System (Groundwater Alternative 4)

Groundwater Alternative 4 consists of installing a groundwater containment feature in the western and southern portions of the site, as shown on Figure 3. The containment features are identified as "West Containment" and "South Containment". The containment features, which will likely consist of an extraction trench, are expected to intercept lead- and arsenic-impacted groundwater from migrating offsite. It is currently estimated that the West Containment will be 150 lineal feet and 350 lineal feet for the South Containment. Both containments will be 15 feet deep and 5 feet wide. If necessary, groundwater collected in the extraction trench will receive pre-treatment onsite prior to discharge to the local publicly owned treatment works (POTW). Upgradient and

downgradient monitoring wells will be installed and sampled to verify that lead- and arsenic-impacted groundwater is contained onsite. The estimated capital cost for installing the groundwater containment and treatment components is $0.7 million. The estimated present worth for O&M costs is $1.2 million.

2.4 Sediment Removal and Marsh Restoration (Marsh Sediments Alternative 2A)

The upper 12 inches of sediments will be excavated from the marsh areas, as shown on Figure 3. It is estimated that approximately 1,500 cy of marsh sediments will be removed. Following removal, the sediments will be stabilized (as needed) and placed as subgrade fill beneath the LPEB. In the marsh area, a final cover will be installed to re-establish the wetland marsh environment. The estimated capital cost for Alternative 2A is approximately $0.9 million.

The total estimated capital cost for the NTCRA is approximately $3.2 million.

3. Sequencing and Design Packages

It is BBL's experience that projects with multiple removal components, categorized according to media, usually require the development of a number of design packages based on numerous items. These differentiating items could include construction sequencing, media type, pre-design data collection requirements, permitting timeframes, and the use of specialty contractors or equipment for certain aspects of the work.

The sequence of NTCRA work typically proceeds from a groundwater and surface-water upgradient point in a downgradient direction. In addition, for this NTCRA, all three of the main activities will potentially generate material that will be required to be placed as subgrade fill beneath the LPEB. These activities include the stabilization of soils, the installation of the groundwater containment system, and the excavation of marsh sediments. Finally, the activities associated with stabilization, LPEB installation, sediment removal, and groundwater containment system installation will likely require different types of contractors/or and equipment. For these reasons the following sequencing is proposed for implementing the NTCRA:

- Demolition of some site facilities will be conducted during the NTCRA design approval process. The demolition of the Storage Yard area and removal of the existing debris is required for access purposes.

- A stormwater management and control system will be installed prior to beginning NTCRA activities to provide erosion control that will minimize sediment discharge from the stormwater during construction activities. In addition, ExxonMobil will work with the USEPA and SCDHEC to develop appropriate methods for collecting and discharging stormwater.

- After the stormwater management system is installed, the proposed initial phase of the work includes the ex situ stabilization of slag located in the saturated zone within the horizontal and vertical limits shown on Figure 5. The stabilization activity will generate bulked stabilized material that will require blending into the LPEB subgrade.

- The slag and/or magenta-stained soil located in the vadose zone will be stabilized concurrently with the saturated zone slag removal and stabilization. The horizontal and vertical limits of this work are shown on Figure 6. Bulked stabilization material from this activity will also require blending into the LPEB subgrade.

- The groundwater containment and treatment system will be installed after the stabilization work is completed. Depending on the type of containment feature installed, generated material may require blending into the LPEB subgrade. Installation of the containment features may require specialty equipment for trenching to the required depths.

- The sediment removal work within the marsh will proceed when the stabilization activities and groundwater containment features are in place. This work will generate sediment material that may require stabilization prior to placement beneath the LPEB as subgrade material. These activities may require specialty marsh equipment.

- The stormwater management system will be maintained in place during all construction work.

- Finally, the LPEB will be the last component installed. This will require the use of grading equipment capable of meeting fine grading requirements.

Based on the above sequencing approach the following four design packages are proposed:

- Design Package No. 1 – Demolition Plan;
- Design Package No. 2 – Slag and Soil Stabilization and Lower-Permeability Exposure Barrier;
- Design Package No. 3 – Groundwater Containment and Treatment System; and
- Design Package No. 4 – Sediment Removal and Marsh Restoration.

The preparation of each design package requires the preparation of pre-design investigations, permitting, and design analysis. Sections 4 through 7 detail each design package.

Breaking the NTCRA design activities into four design packages facilitates review of the design packages in a phased process and shortens the review cycles. As discussed in the following section, the deliverable for Design Package No. 1 – Demolition Plan will not require USEPA and SCDHEC approval.

4. Design Package No. 1 – Demolition Plan

This section of the RADWP addresses demolition activities required to obtain access for implementation of the NTCRA. The demolition activities at the site will, at a minimum, address the Storage Yard area that is currently covered with various building materials, storage sheds, and miscellaneous debris

The activities that will be performed and the documents that will be prepared to complete the demolition activities are described in the following subsections. These items are included as Tasks 17 through 28 on the RADWP Implementation Schedule (Figure 4).

4.1 Basis of Design

A BOD will be developed to serve as the primary document to communicate technical guidance and design intent to all parties involved. The BOD will be refined, as required, during the NTCRA design efforts. An updated BOD will be submitted with the Final 100 Percent Design.

The following summarizes the Basis of Design (BOD) for Design Package No. 1:

- The area of the Storage Yard must be cleared to provide access to the soils required to receive stabilization and/or LPEB and to install the groundwater containment features. The Storage Yard contains various building materials, several storage sheds, and miscellaneous debris.

- A Demolition Plan will be developed to provide a contractor direction for this work. The Demolition Plan will include a schedule of work identifying those items that are to be removed and disposed of, salvaged, relocated, protected, or modified. ExxonMobil will work with the Property Owner to identify the pertinent demolition activity for each item.

- Acceptable disposal and decontamination requirements for each demolition item will be identified in the Demolition Plan.

The BOD will be updated and refined as the project progresses.

4.2 Pre-Design Investigation

A pre-design data collection effort will be initiated prior to beginning design activities. The pre-design data collection effort will include the following activity:

- Visual Inventory: A site-wide inventory will be performed to evaluate and categorize demolition items. The inventory will define existing buildings, storage sheds, equipment, or miscellaneous debris to be addressed as part of the Demolition Plan.

- Photographic Inventory: To accompany the Visual Inventory each demolition item will be photographed.

4.3 Permitting

For this design package, the only permitting issue will be related to property owner negotiation. The activities and timing required to obtain property owner approval of the Demolition Plan will be included in the Permitting Plan, which is discussed in Section 8.

4.4 Design Deliverables

The design deliverable for the Demolition Plan will consist of a Scope of Work, demolition schedule, photograph catalog, and drawings of the identified demolition items. The work associated with Design Package No. 1 is preparatory work required to gain access for the implementation of Design Packages Nos. 2 through 4. Design Package No. 1 involves non-environmental tasks. ExxonMobil proposes to submit the Demolition Plan to the USEPA and SCDHEC for review and comment only, with no approval requested.

4.5 Bid Construction Process

Following submittal of the Demolition Plan to the USEPA and SCDHEC a bid package will be prepared to solicit bids from demolition contractors. A demolition contractor, as opposed to a typical environmental contractor that would be qualified to implement Design Packages Nos. 2 through 4, is recommended to implement the Demolition Plan.

For Design Package No. 1 the durations of the bid process and implementation are identified on the RADWP Implementation Schedule (Figure 4) as Tasks 25 through 28. ExxonMobil's schedule objective for this design package is to implement the work in late 2005/early 2006, concurrent with the completion of Design Packages Nos. 2 though 4. Achieving this schedule objective would reduce a potential delay in the implementation of the NTCRA in 2006.

5. Design Package No. 2 – Slag Soil Stabilization and Lower-Permeability Exposure Barrier

This section of the RADWP addresses:

- removal of site soil via stabilization and installation of a LPEB.

The activities that will be performed and the documents that will be prepared to complete the Slag Soil Stabilization and LPEB Design are described in the following subsections. These items are included as Tasks 29 through 45 on the RADWP Implementation Schedule (Figure 4).

5.1 Basis of Design

As previously discussed, the BOD serves as the primary document to communicate technical guidance and design intent to all parties involved. During the NTCRA design efforts, the BOD will be refined as required. An updated BOD will be submitted with the Final 100 Percent Design.

The following summarizes the BOD for Design Package No. 2:

- Delineation of the stabilization areas was based on visual observation of slag and magenta-stained soil in soil and monitoring well borings, as well as on soils with toxicity characteristic leaching procedure (TCLP) results greater than 5 milligrams per liter (mg/L) for arsenic or lead. The visual surveys were conducted during site walks and soil boring activities; all stabilization areas are identified with blue hatching on Figure 3.

- The stabilization for vadose zone slag and soil will occur either in-situ or ex-situ. The soils will be stabilized with the objectives of reducing concentrations to below the 5-mg/L TCLP for arsenic and lead and reducing leachability to groundwater.

- The horizontal and vertical limits of the vadose zone stabilization are shown on Figure 6. The approximate volume of soils to be stabilized either in-situ or ex-situ within the vadose zone is 11,000 cy. QA/QC procedures utilizing visual observation will be implemented to ensure that all impacted soil is stabilized.

- Slag within the saturated zone also requires stabilization. The steps for stabilizing saturated-zone slag consist of removal, stabilization, and placement as subgrade fill beneath the LPEB. The excavated area will be backfilled with clean material. The horizontal and vertical limits of the saturated zone stabilization are shown on Figure 5. The approximate volume of slag to be stabilized within the saturated zone is 5,500 cy. QA/QC procedures utilizing visual observation will be implemented to ensure that all impacted soil is stabilized.

- The LPEB areas were determined by the surface soils (0 to 1 foot bgs) that exceeded the Industrial Soil SSALs (arsenic = 27 mg/; lead = 895 mg/kg). The approximate areas of the LPEB are identified with green shading on Figure 3.

- The LPEB will consist of a geotextile for demarcation between the LPEB and underlying soil, and a lower impermeable layer (e.g., compacted clay covered with 6 inches of topsoil and vegetation, concrete, asphalt, or similar). Once all other NTCRA activities are complete, subgrade leveling will be required prior to the placement of the geotextile.

- The LPEB will provide long-term effectiveness by isolating impacted soils from human contact, reducing the mobility of arsenic and lead in soil with respect to surface-water transport, and reducing infiltration of precipitation and the subsequent potential leaching of arsenic and/or lead to the groundwater.

- Portions of the site outside the removal limits may be utilized for equipment access when implementing the soil NTCRA. These areas will be revegetated, as necessary, and returned to original condition upon completion of the NTCRA.

- Erosion and stormwater control measures will be implemented prior to initiating excavation work.

- Following completion of the NTCRA, a long-term monitoring plan will be implemented that consists of inspection, maintenance and repair of the LPEB. Future land use will be dictated by institutional controls.

The BOD will be updated and refined as the project progresses.

5.2 Pre-Design Investigation

A pre-design data collection effort will be initiated prior to beginning design activities. The objective of this activity is to collect the data needed to complete the NTCRA Design. The pre-design data collection effort will include the following activities:

- Topographical Survey: A sitewide topographical survey exists for the site; however, it may be necessary to collect supplemental survey data for the pre-design activities.

- Office of Coastal Resource Management (OCRM) Line: Work that encroaches within the OCRM line requires a disturbance permit from the OCRM. The data from Appendix D (*Wetland Delineation Report*) of the EE/CA Report will be used to locate the OCRM line for design activities.

- Stormwater Permit Requirements: A meeting will be scheduled with the SCDHEC to discuss general versus Individual NPDES Stormwater Permit requirements and to address management of stormwater during construction.

5.3 Permitting

The site is located within a complex environmental area that includes tidal zones, wetlands, floodplains, drainage ways, uplands, and salt marshes. Removal activities planned for the site will affect each of these zones and will be subject to several federal, state and local regulatory programs. A systematic approach to identifying and acquiring all necessary permits is important to maintaining design and construction schedules, and to meeting the overall objective of the site NTCRA.

Permits under Section 404 of the Clean Water Act (CWA) or Section 10 of the Rivers and Harbors Act, (Section 10 and 404) are not required for activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Based on past experience in Charleston, the U.S. Army Corps of Engineers (USACE) will probably defer to the USEPA and SCDHEC for required permits during the implementation of the NTCRA. For this design package, the OCRM will issue a Stormwater Permit for any land disturbance activities that occur on the upland portions of the site. The activities and timing required to obtain the Stormwater Permit will be included in the Permitting Plan, which is discussed in Section 8.

5.4 Design Analysis

For Design Package No. 2, a series of design analyses will be performed to technically support the final design. Each of these analyses will be finalized in a calculation or project note format, or presented in the 30 Percent Design. In accordance with BBL Quality Control Procedures, each calculation and project note will be reviewed and checked by an engineer technically qualified in the appropriate field.

This design effort will likely include the following design analyses:

- hydrologic analyses;
- hydraulic analyses;
- assessment of excavation techniques;
- evaluation of stabilizing methods and materials;
- property owner coordination;
- assessment of construction logistics, including staging areas and material handling methods;
- filter design for geotextile;
- assessment of impacts to adjacent areas;
- development of erosion and sediment control plan; and
- calculation of quantities and development of a cost estimate.

Based on the results of the above analyses, BBL will develop a recommended NTCRA approach for the stabilization areas and present this approach as Design Package No. 2 – 30 Percent Design Report.

5.5 Design Deliverables

As described above, the various pre-design activities will focus on obtaining topographic data and analyzing the existing hydrologic conditions. ExxonMobil recommends a 30 Percent Design Report to obtain input from the USEPA and SCDHEC prior to initiating final design activities. The 30 Percent Design Report will present the information developed in the previous tasks and will include descriptive text, relevant data used in developing the design, definition of stabilization limits, draft construction drawings and specifications, monitoring and performance requirements, review of constructability issues, permitting requirements, and the recommended approach for the soil stabilization.

The 30 Percent Design Report will be submitted to the USEPA and SCDHEC for review and comment. A Final Design will be developed concurrently with the review of the 30 Percent Removal Action Design. The Final Design will incorporate agreed-upon comments and design changes recommended in the review. The Final Removal Action Design will include plans and specifications suitable for construction of the NTCRA. Additionally, required monitoring and performance plans and schedules will be included.

5.6 Bid Construction Process

Following USEPA and SCDHEC approval of the Final Removal Action Design, a bid package will be prepared to solicit bids from approved contractors. Separate bid packages may be developed for each component of the work. Bid packages may be combined for work at the other Former VCC sites.

The bid construction process is not shown as an activity on the RADWP Implementation Schedule because this is considered the beginning of the construction-phase activities. It is expected that these construction-phase, as well as permitting activities will begin following the completion of the design activities. Upon award of contracts for implementation of the NTCRA, an overall project schedule that encompasses construction activities will be submitted.

6. Design Package No. 3 – Groundwater Containment and Treatment System

This section of the RADWP addresses:

- interception of off-site migration of impacted groundwater through collection and, if needed, treatment.

The activities that will be performed and the documents that will be prepared to complete the Groundwater Containment and Treatment Design are described in the following sections. These items are included as Tasks 46 through 64 on the RADWP Implementation Schedule (Figure 4).

6.1 Basis of Design

As previously discussed, the BOD serves as the primary document to communicate technical guidance and design intent to all parties involved. During the NTCRA design efforts, the BOD will be refined as required. An updated BOD will be submitted with the Final 100 Percent Design.

The following summarizes the BOD for Design Package No. 3:

- The SSALs for site groundwater are the USEPA Maximum Contaminant Levels (MCLs).
- Groundwater investigations conducted in 2001 and 2003 indicated that arsenic-impacted groundwater extended approximately 9.3 acres of the 15-acre site, as depicted in Figure 2-13 of the EE/CA Report. The West and South Containments, identified on Figure 3, are expected to intercept the arsenic-impacted groundwater prior to offsite migration.
- Groundwater investigations conducted in 2001 and 2003 indicated that lead-impacted groundwater extended approximately 5 acres of the 15-acre site, as depicted in Figure 2-14 of the EE/CA Report. The West and South Containments, identified on Figure 3, are expected to intercept the lead-impacted groundwater prior to offsite migration.
- The acidic nature of the groundwater (Figure 2-16 in the EE/CA Report) will be considered when designing the West and South Containments.
- Figure 3 shows the preliminary location of the groundwater containment areas. The South Containment is approximately 350 lineal feet, and the West Containment is approximately 150 lineal feet. The final horizontal location of these containment areas, as well as the type of containment (e.g., interception trench/wall or wells) will be based on groundwater modeling to be performed as part of the pre-design data collection.
- The vertical limits of the interception trench/wall are estimated to be 15 feet below grade, with termination into an underlying intermediate clay confining unit. The location of this underlying unit along the proposed alignment will be confirmed as part of the pre-investigation data collection effort.

- Groundwater will be collected from the containment areas. Pre-treatment may be required onsite prior to discharge to the POTW.

- The collection system hydraulic design will be based on site groundwater data and the results of the groundwater modeling effort.

- Potential inflow from the Ashley River into the West Containment area will be considered.

The above BOD will be updated and refined as the project progresses.

6.2 Pre-Design Data Collection

As part of the EE/CA Report, groundwater pre-design data were collected at the site. The data concluded that the areas of arsenic- and lead-impacted groundwater are roughly centered around or downgradient from the former Stono Phosphate buildings and the former acid chambers.

Additional investigative activities are required to support the final design of the NTCRA. Groundwater flow and geochemical conceptual models will be developed to select locations for the groundwater extraction systems based on capture-zone analysis and the estimated constituent concentrations in (and volume of) groundwater extracted from the planned trenches to develop the groundwater treatment system. The geochemical conceptual model will provide an understanding of the sources and subsurface transport of lead and arsenic when assessing implications for the removal design.

A MODFLOW groundwater flow model will be developed as follows:

- A conceptual MODFLOW groundwater flow model will be developed based on existing data to select planned locations for the extraction trenches (based on capture zone analysis) and to assist with designing pilot tests.

- Pumping tests will be performed in the planned locations of the extraction trenches to measure the site-scale hydraulic conductivity of the target removal zones and to provide a basis for estimating concentrations of constituents of concern (COCs) in groundwater extracted from the planned trenches.

    - Requires the installation of one pumping well and two piezometer clusters (three "nested" piezometers at each cluster for a total of six piezometers) and the extraction of groundwater from the pumping well for 72 hours.

- A complete round of groundwater sampling for the analytes listed below will be performed at the existing monitoring network (including the pumping well and piezometers located along the proposed extraction trench locations) to provide a basis for estimating concentrations of COCs in groundwater extracted from the planned trenches, for selecting pumps and piping, and for estimating the level of effort required for long-term maintenance.

    - Determine if extracted groundwater is corrosive (low pH), which would require careful selection of construction materials.
    - Determine if extracted groundwater contains dissolved metals and other inorganic constituents that may form solid precipitates and potentially foul pumping/piping equipment.

Recommended Groundwater Analytes	Sample Analysis Method
pH	Field meter
Temperature	Field meter
Specific conductivity	Field meter
Dissolved oxygen	Field meter
Oxidation-reduction potential	Field meter
Turbidity	Field meter
Lead (filtered and unfiltered)	SW-846
Arsenic (filtered and unfiltered)	SW-846
Sodium	SW-846
Magnesium	SW-846
Calcium	SW-846
Potassium	SW-846
Iron (filtered and unfiltered)	SW-846
Chloride	SW-846
Bicarbonate/alkalinity	SW-846
Sulfate	SW-846
Nitrate	SW-846
Manganese (filtered/unfiltered)	SW-846
Total dissolved solids	SW-846
Total organic carbon	SW-846
Dissolved carbon dioxide	SW-846

- The conceptual MODFLOW model will be calibrated based on the pilot test results. The calibrated model will be used to assist with engineering design to estimate the groundwater extraction rates required to capture impacted groundwater, and to estimate the expected constituent concentrations in extracted groundwater.

A Geochemical Conceptual Model (GCM) will be developed based on existing data and on data collected during the pilot tests. The GCM will focus on the implications for removal. Treatment/removal of impacted groundwater at the site is primarily associated with inorganic chemicals. For an efficient groundwater removal action, the site-specific inorganic reactions and transport pathways will be evaluated. The GCM will assess the sources and subsurface transport of lead and arsenic, pH conditions, and other geochemical influences on metals transport. The results will indicate associated implications for removal, such as the need for a water treatment system. In the event that a treatment system is required, the GCM data will be evaluated for design-related issues (e.g., corrosion and scale build-up).

Additional pre-design data collection activities will include:

- Geotechnical Investigation: Installation of a series of borings along the proposed alignment of the extraction trenches to determine soil classification and the types of bulk fills to be encountered and to confirm the depth of the underlying confining layer.

- Bathymetric Survey: As shown on Figure 3, the West Containment is located adjacent to the Ashley River. Bathymetric survey data may be collected in order to understand the current elevations of the

Ashley River sediments and provide data for structural loading analysis on any containment structure to be designed and installed.

- POTW Discharge: Current plans for the collected groundwater from the containment features call for discharge to the local POTW. For this task, BBL will meet with POTW personnel to identify discharge criteria such as quantity, quality, discharge location, monitoring, fees, and necessary permits.

The USEPA will be notified at least 10 days in advance of any sample collection activities related to the groundwater or geotechnical investigations.

6.3 Permitting

Design Package No. 3 permitting activities will focus on discharge requirements to the POTW. Erosion and sediment control permits will be covered by the other design packages, and no wetlands should be impacted as a result of installing the containment features.

The activities and timing required to obtain the POTW discharge permit will be included in the Permitting Plan, which is discussed in Section 8.

6.4 Design Analyses

A series of design analyses will be assembled to technically support the final design for Design Package No. 3. The following design analyses will likely be required:

- presentation of the groundwater flow and geochemical conceptual models;
- development of the collection system design parameters, such as flow rates, contaminant concentrations, removal elevations; containment method (i.e., wall versus wells); and collection approach;
- evaluation and development of containment method and features;
- potential impact of inflow from the Ashley River;
- treatment requirements, such as pretreatment onsite or direct discharge to the POTW;
- long-term monitoring and performance objectives;
- evaluation of bulkhead constraints in regard to the West Containment and consider replacement;
- assessment of alternative extraction features such as wells;
- filter design for trench backfill media;
- property owner coordination;
- assessment of construction logistics, including staging areas, ingress and egress points, material handling methods, and material dewatering techniques;
- assessment of impacts to adjacent areas; and
- calculation of quantities and development of a cost estimate.

Depending on the results of the above analyses, the West Containment feature may be different from the South Containment feature based on site constraints resulting in constructability issues. The deliverable from this activity will be the technical material required for the Design Package No. 3 – 30 Percent Design Report.

6.5 Design Deliverables

As described above, the various pre-design activities will focus on further refining the groundwater flow regime and on analyzing containment alternatives. ExxonMobil recommends a 30 Percent Design Report in order to obtain input from the USEPA and SCDHEC prior to initiating final design activities. The 30 Percent Design Report will present the information developed in the previous tasks and will include descriptive text, relevant data used in developing the design, results of the groundwater modeling, proposed containment and collection design parameters, alternative analysis of various containment options, treatment scheme, monitoring and performance requirements, review of constructability issues, permitting requirements, and the recommended approach for the groundwater containment and treatment system.

The 30 Percent Design Report will be submitted to the USEPA and SCDHEC for review and comment. Subsequent to the review of the 30 Percent Removal Action Design, a Final Design will be developed. The Final Design will incorporate agreed comments and design changes recommended in the review. The Final Removal Action Design will include plans and specifications suitable for construction of the NTCRA measures specified. Additionally, required monitoring and performance plans and schedules will be included.

6.6 Bid Construction Process

For Design Package No. 3, the bid construction process will be similar to that described in Section 5.6.

7. Design Package No. 4 – Sediment Removal and Marsh Restoration

This section of the RADWP addresses:

- removal of marsh sediment by excavation and onsite containment of excavated sediments beneath the LPEB, and restoration of the marsh to original conditions.

The activities that will be performed and the documents that will be prepared to complete the Sediment Removal Action Design are described in the following sections. These items are included as Tasks 65 through 82 on the RADWP Implementation Schedule (Figure 4).

7.1 Basis of Design

As previously discussed, the BOD serves as the primary document to communicate technical guidance and design intent to all parties involved. During the NTCRA design efforts, the BOD will be refined as required. An updated BOD will be submitted with the Final 100 Percent Design.

The following summarizes the BOD for Design Package No. 4:

- The SSAL for sediments is the Mean ERM Quotient: Categories 3 and 4. However, it should be noted that samples within the area of impacted sediment to be excavated (as defined by samples with Mean ERM Quotients of 3 and 4 may have a mean ERM Quotient of 1 or 2 but will still be excavated because they lie within the pre-determined excavation boundaries.

- The approximate area of impacted sediment in the marsh is 0.75 acre in two areas. These two areas are identified on Figure 3 as Marsh Areas I and II.

- As shown on Figure 2-18 of the EE/CA Report, 11 sample points were utilized to develop the horizontal limits of Marsh Area I. Additional sampling is proposed to refine the southern limits of sediment removal in Marsh Area I.

- Also shown on Figure 2-18 of the EE/CA Report are the 4 sample points utilized to develop the horizontal limits of Marsh Area II. No additional sampling is required for this area. The horizontal limits of removal for Marsh Area II will be as shown on Figure 3.

- QA/QC procedures utilizing visual observation will be implemented during removal activities to ensure that magenta- impacted sediment is removed.

- Soil in the marsh consists of two layers. The upper layer is the biologically active zone and consists of a vegetated soft clay or peat that is permanently saturated. The upper layer is approximately 1 foot thick. The second layer consists of a very soft gray clayey material that is permanently saturated and provides little bearing capacity. This second layer is referred to locally as Pluff Mud. The vertical limits of sediment removal will be the first 12 inches, which coincide with the biological active zone; no excavation of Pluff Mud will be performed.

- The marsh areas are tidally influenced. Construction sequencing management of the tidal influence will be considered during the design process.

- Reestablishment of the marsh areas will consist of a three-component exposure barrier. The bottom component will consist of a geotextile fabric that will serve three functions: demarcation barrier, geotechnical bearing support/separation, and isolation barrier for the benthic community. The second layer will consist of 12 inches of clean imported fill material to reestablish the marsh elevation. Finally, the third component will be reestablishment of the appropriate salt- or freshwater vegetation.

- As part of implementation of the sediment NTCRA, portions of the marsh outside of the removal limits may be utilized for equipment access and tidal control berms. These areas will be revegetated upon completion of the NTCRA.

- Following completion of the NTCRA, a monitoring plan will be implemented.

The above BOD will be updated and refined as the project progresses.

7.2 Pre-Design Data Collection

A pre-design data collection effort will be initiated prior to beginning design activities. The objective of this activity is to collect the required data needed to perform the NTCRA Design. The pre-design data collection effort will consist of the following activities:

- Topographical Survey: A topographical survey will be performed. The survey will be developed on a grid basis so that existing topography can be assessed during the design stage.

- Supplemental Marsh Investigation: Supplemental sediment sampling will be conducted along the south boundary of Marsh Area I to verify the limits of impacted marsh sediments. The proposed sampling locations are shown on Figure 3. The samples will be collected from the top 0 to 0.5 foot of the sediment surface and will be analyzed for Target Analyte List (TAL) metals, pH, and total organic carbon.

- OCRM Line: Work that encroaches within the OCRM line requires a disturbance permit from OCRM. The data from Appendix D (*Wetland Delineation* Report) of the EE/CA Report (BBL, March 2002) will be utilized to locate the OCRM line for design activities.

- Geotechnical Investigation: A geotechnical investigation will be performed in the marsh areas to collect soil samples for geotechnical analyses to determine the capacity of the existing marsh soils to support construction equipment, tidal berms, and the exposure barrier.

- Reference Marsh: ExxonMobil will discuss the need for a reference marsh with the USEPA and SCDHEC. A reference marsh is typically utilized to compare the rate and progress of revegetation against an existing marsh. ExxonMobil will identify a reference marsh, as required.

The USEPA will be notified at least 10 days in advance of any sample collection activities related to the marsh or geotechnical investigations.

7.3 Permitting

As stated in Section 5.3, the site is located within a complex environmental area that is subject to several federal, state and local regulatory programs. A systematic approach to identifying and acquiring all necessary permits is important to maintaining design and construction schedules, and to meeting the overall objective of the site NTCRA.

The SCDHEC OCRM requires consistency certification because fill material is to be placed in critical area wetlands, as well as a Stormwater Permit for any land disturbance activities that occur on the upland portions of the site. The activities and timing required to obtain the consistency certification and Stormwater Permit will be included in the Permitting Plan, which is discussed in Section 8.

7.4 Design Analyses

A series of design analyses will be performed to technically support the final design for Design Package No. 3. Each of these analyses will be finalized in a calculation or project note format, or presented in the 90 Percent Design. In accordance with BBL Quality Control Procedures, each calculation and project note will be reviewed and checked by an engineer technically qualified in the appropriate field.

For this design effort the following design analyses are probable:

- tidal control and access berm structural design;
- assessment of excavation techniques;
- elevation analysis of tidal control berm;
- filter design for geotextile selection;
- stormwater diversion analyses;
- property owner coordination;
- assessment of construction logistics including staging areas, ingress and egress points, material handling methods, and material dewatering techniques;
- assessment of impacts to adjacent areas;
- development of erosion and sediment control plan;
- development of planting strategies; and
- calculation of quantities and development of a cost estimate.

Based on the results of the above analyses, a recommended NTCRA approach will be developed for each of the three marsh areas. The deliverable from this activity will be the technical material required for the Design Package No. 4 – 90 Percent Design Submittal.

7.5 Design Deliverables

ExxonMobil will submit to USEPA and SCDHEC a pre-design memorandum presenting the marsh sediment removal lateral limits established by utilizing pre-confirmatory sampling (data presented in the EE/CA report and additional data collected as part of RADWP activities). Concurrence of the boundaries as the sediment removal limits will be obtained prior to initiating design activities.

Upon completion of the design analysis tasks, a 90 Percent Design Submittal for the Marsh Areas will be completed. This submittal will present the information developed in the previous tasks and will include a detailed cover letter, relevant data used in developing the design, relevant engineering calculations and analyses, technical support literature, schedules, a sediment and erosion control plan, a preliminary vegetation restoration and monitoring plan, relevant construction specifications, and design drawings. The design drawings will include information to a 90 Percent Design level, such as areas of excavation/fill, cross-sections, typical design details, vegetation plantings, construction staging areas, and ingress/egress points.

The 90 Percent Removal Action Design will be submitted to the USEPA and SCDHEC for review and comment. Subsequent to the review of the 90 Percent Removal Action Design, a Final Design will be developed. The Final Design will incorporate agreed-upon comments and design changes recommended in the review. The Final Removal Action Design will include plans and specifications suitable for construction of the NTCRA measures specified. Additionally, required monitoring plans and schedules will be included.

7.6 Bid Construction Process

For Design Package No. 4, the bid construction process will be similar to that described in Section 5.6.

8. Project Plans

8.1 Health and Safety Plan

A site-specific HASP has been developed and used during the EE/CA investigation activities performed at the site. The EE/CA HASP has been updated to cover activities to be performed as a part of the RADWP and submitted under separate cover in accordance with the AOC requirements as the RADWP HASP. The RADWP HASP addresses the pre-design and design activities shown on the RADWP Implementation Schedule (Figure 4). A Removal Action Design Implementation HASP will be prepared and submitted upon USEPA approval of the Final Removal Action Designs.

The RADWP HASP is consistent with Occupational Safety and Health Administration (OSHA) guidelines developed to provide safe working procedures that minimize risks to human health and the surrounding environment. Procedures and protocols set forth in the HASP are designed to reduce the potential risks of exposure to chemical substances and physical hazards that may be present at the site. These procedures were developed in accordance with the provisions set forth by 29 Code of Federal Regulations CFR 1910.120 (Hazardous Waste Operations and Emergency Response) and other appropriate regulations. The procedures and protocols may be modified during the course of the activities as additional information becomes available during on-site characterization or through laboratory chemical analyses. These modifications will be issued in the form of revisions to specific pages or sections of the RADWP HASP.

The preparation and submittal of the RADWP HASP is shown as Task 11 on the RADWP Implementation Schedule (Figure 4).

8.2 Quality Assurance Project Plan

The QAPP, included as Appendix B, has been prepared for the activities to be performed for this RADWP. The QAPP describes the necessary policy, organization, and quality assurance and quality control protocols necessary to achieve data quality objectives dictated by the intended use of the data, and was prepared in compliance with USEPA requirements for QAPPs (USEPA QA/R-5). The purpose of the QAPP is to ensure that all appropriate USEPA analysis protocols are followed.

The preparation and submittal of the QAPP is shown as Task 12 on the RADWP Implementation Schedule (Figure 4).

8.3 Permitting Plan

A Permitting Plan will be prepared to define the permits and supporting documentation required for implementing the NTCRA. The Permitting Plan will be used as the management tool for tracking permit preparation, supporting documentation, submittal, agency review, and approvals. Permitting issues are likely to change throughout the permitting process. For this reason, the Permitting Plan will be considered a working document to be reviewed and updated on a regular basis. The preparation and submittal of the Permitting Plan is shown as Task 13 on the RADWP Implementation Schedule (Figure 4).

8.4 Project Management Plan

A Project Management Plan will also be prepared for the activities to be performed for this RADWP. The purpose of the Project Management Plan is to communicate to the project team essential facts about the project and the qualitative considerations that influence the project work efforts. The Project Management Plan is not required by the AOC but is an internal ExxonMobil and BBL quality procedure. This activity is shown as Task 14 on the RADWP Implementation Schedule (Figure 4). The Project Plan will not be submitted to the USEPA.

9. Project Organization and Reporting

9.1 Project Organization

On behalf of ExxonMobil, Michael Skinner has overall responsibility for the RADWP activities. Mr. Skinner is supported by BBL. BBL personnel will perform related sampling activities, evaluate data, and prepare the deliverables following USEPA approval of the RADWP. A list of key project management personnel is provided below.

Company/Organization	Title	Name	Phone Number
USEPA	Remedial Project Manager	Ken Mallary	(404) 562-8802
SCDHEC	Project Manager	Mihir Mehta	(803) 896-4088
ExxonMobil	Project Coordinator	Michael Skinner	(856) 429-5336
BBL	Project Manager	Troy Hopper	(713) 785-1680 x11
	Project QA/QC	Geoff Germann	(919) 469-1952 x22
	Project Remediation Engineer	Mark Gravelding	(315) 446-2570 x235
	Project Hydrogeologist	Dave Lipson	(303) 231-9115 x114
Sabine & Waters	Wetland Specialist	Bart Sabine	(843) 830-5807

9.2 Reporting

In compliance with the AOC, and following USEPA approval of the RADWP, written progress reports will be submitted by ExxonMobil to the USEPA until termination of the AOC. The AOC indicates progress report submittals every thirtieth day, unless otherwise directed by the Remedial Project Manager in writing. The progress reports will describe the following:

- significant developments during the preceding period, including the actions preformed and any problems encountered;
- analytical data received during the reporting period; and
- developments anticipated during the next reporting period, including a schedule of actions to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

Within 60 days after completion of all removal activities required under the AOC, ExxonMobil will submit a final report summarizing the removal activities for USEPA review and approval. The final report will conform, at a minimum, with the requirements set forth in Section 300.165 of the National Contingency Plan (NCP) entitled "OSC Reports." The final report will include the following:

- a good faith estimate of total costs or a statement of actual costs incurred in complying with the AOC;
- a list of the quantities and types of materials removed from the site or handled onsite, a discussion of removal and disposal options considered for those materials, and a list of the ultimate destination of those materials;

- documentation of all field change orders and integration into as-built drawings and figures;
- a presentation of the analytical results of all sampling and analyses performed; and
- relevant documentation generated during the NTCRA (e.g., manifests, invoices, bills, contracts, and permits).

The final report will also include a signed certification statement, worded as the final paragraph in Section VIII – Work to be Performed, Item 26 – Final Report of the AOC.

The reporting activities are shown as Task 83 on the RADWP Implementation Schedule (Figure 4).

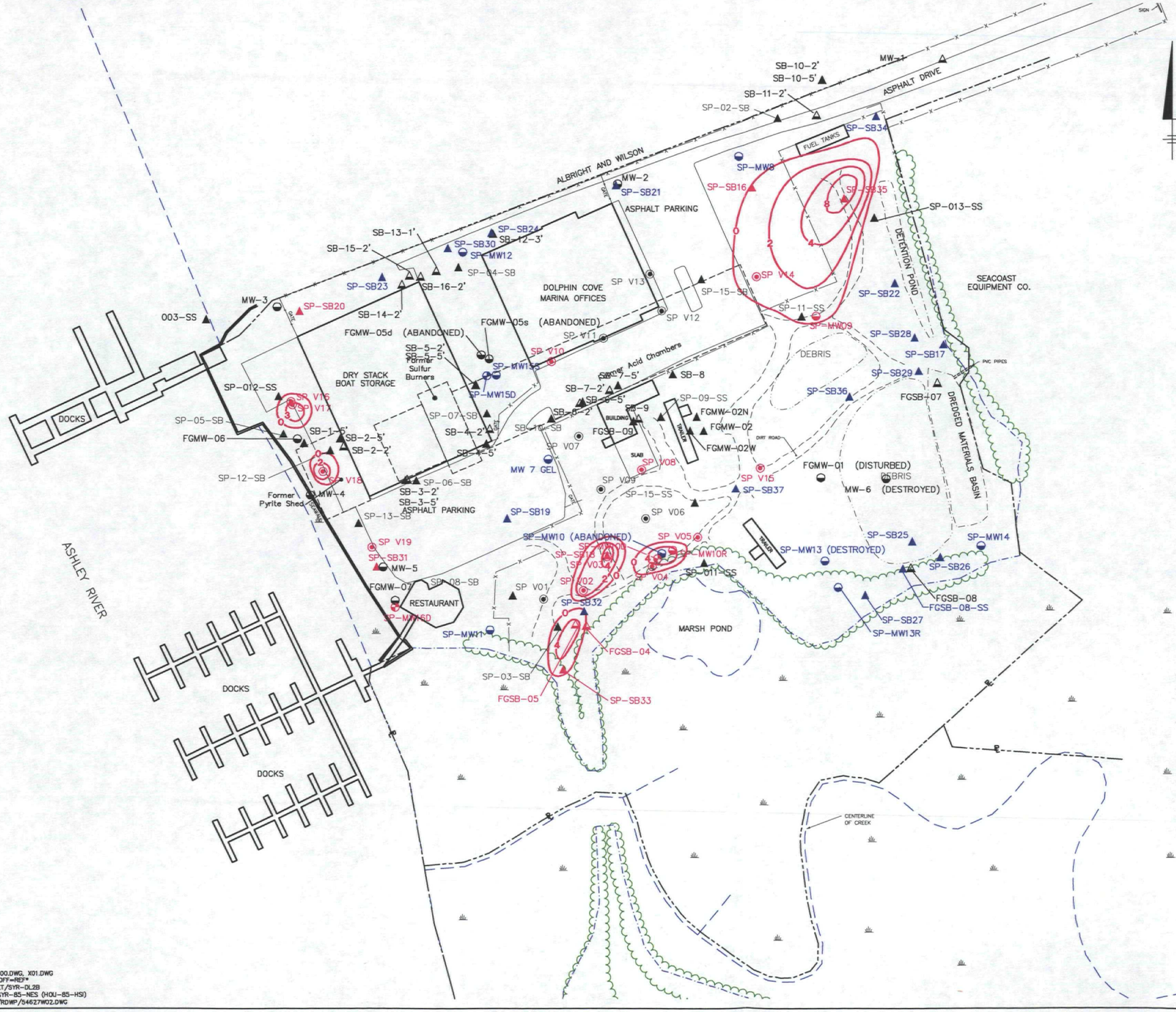
X: 54627X00.DWG, 54627X01.DWG
L: ON=*, OFF=REF
P: PAGESET/PLT-DL
3/1/05 SYR-85-NES (HOU-850HSI)
54627014/RDWP/54627B01.DWG

FORMER STONO PHOSPHATE WORKS SITE
CHARLESTON, SOUTH CAROLINA
REMOVAL ACTION DESIGN WORK PLAN

SITE PLAN & GENERAL NTCRA COMPONENTS

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE 3



LEGEND:

- FENCE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES AND AREAS
- WATER FEATURES
- APPROXIMATE TREE LINE
- WETLAND BOUNDARY
- APPROXIMATE PROPERTY LINE
- MARSH
- APPROXIMATE LIMITS OF MAGENTA SLAG AND GRAVEL
- SP V15 — PHASE I SOIL BORING LOCATION
- SP V15 — PHASE I SOIL BORING CONTAINING MEASURABLE MAGENTA SLAG
- SP-02-SB, SP-02-SS — SOIL SAMPLE LOCATION (USEPA SEPT. 1999)
- SB-8 — SOIL SAMPLE LOCATION (GEL, OCT. 1996)
- 003-SS — SOIL SAMPLE LOCATION (SCDHEC PA/SI, MARCH 1998)
- FGSB-07 — SOIL SAMPLE LOCATION (TFG, FEB. 2000)
- SP-SB22 — SOIL SAMPLE LOCATION (BBL EE/CA)
- SP-SB16 — SOIL SAMPLE LOCATION CONTAINS MEASURABLE MAGENTA SLAG (BBL EE/CA)
- MW-6 — MONITORING WELL INSTALLED BY GENERAL ENGINEERING LABORATORIES
- FGMW-01 — MONITORING WELL INSTALLED BY THE FORRESTER GROUP
- SP-MW09 — SHALLOW MONITORING WELL INSTALLED BY BBL
- SP-MW10D — DEEP MONITORING WELL INSTALLED BY BBL
- SP-MW09 — SHALLOW MONITORING WELL CONTAINING MEASURABLE MAGENTA SLAG (BBL EE/CA)

NOTES:

1. BASE MAP BY ROBERT FRANK SURVEYING, MARCH 2001, AT A SCALE OF 1:50.
2. HORIZONTAL DATUM IS BASED ON SOUTH CAROLINA STATE PLANE COORDINATE SYSTEM ZONE 3900 NAD 83 INTERNATIONAL FEET GEOID 99 (CONUS). VERTICAL DATUM IS NGVD 29 U.S. SURVEY FEET ACCURATE TO ± 0.5'.
3. ALL LOCATIONS ARE APPROXIMATE.
4. CONTOURS REPRESENT THICKNESS IN FEET.

0 120' 240'

GRAPHIC SCALE

FORMER STONO PHOSPHATE WORKS SITE
CHARLESTON, SOUTH CAROLINA

REMOVAL ACTION DESIGN WORK PLAN

SLAG ESTIMATED THICKNESS IN SATURATED ZONE

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE 5

X: 54627X00.DWG, X01.DWG
L: ON=*, OFF=REF*
P: PAGESET/SYR-DL2B
5/13/05 SYR-85-NES (HOU-85-HSI)
54627014/RDWP/54627W02.DWG

LEGEND:

- FENCE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES AND AREAS
- WATER FEATURES
- APPROXIMATE TREE LINE
- WETLAND BOUNDARY
- APPROXIMATE PROPERTY LINE
- MARSH
- APPROXIMATE LIMITS OF MAGENTA STAINED SOILS
- APPROXIMATE LIMITS OF MAGENTA SLAG AND GRAVEL
- SP V15 — PHASE I SOIL BORING LOCATION
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- SP-MW10D — DEEP MONITORING WELL INSTALLED BY BBL
- SP-MW09 — SHALLOW MONITORING WELL CONTAINING MEASURABLE MAGENTA SLAG (BBL EE/CA)

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3. ALL LOCATIONS ARE APPROXIMATE.
4. CONTOURS REPRESENT THICKNESS IN FEET.

0 120' 240'

GRAPHIC SCALE

FORMER STONO PHOSPHATE WORKS SITE
CHARLESTON, SOUTH CAROLINA

REMOVAL ACTION DESIGN WORK PLAN

SLAG AND MAGENTA-STAINED SOIL ESTIMATED THICKNESS IN VADOSE ZONE

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE 6

X: 54627X00.DWG, X01.DWG
L: ON=*, OFF=REF*, |CONTOURS, |CONTOURS-IDX, |UT-FUEL_LINE
P: PAGESET/SYR-DL2B
5/13/05 SYR-85-NES (HOU-85-HSI)
54627014/RDWP/54627W01.DWG